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HYBRID ADDITIVE MANUFACTURING OF FORGED COMPONENTS BY HIGHLY PRODUCTIVE LASER CLADDING

Task

By combining conventional processes, such as casting or forging, with additive manufacturing, such as laser material deposition (LMD), research can offer the industry novel manufacturing possibilities for producing innovative components and variants. For example, additively made structural elements can be added onto conventionally produced blanks, generating a component that could not otherwise be built without additional expensive tools.

In the LuFo program, Fraunhofer ILT and its partners OTTO FUCHS, ACCESS and BTU Cottbus are researching the hybrid additive manufacturing of TiAl6V4 forged components for an aerospace application. In this context, the key challenges posed are that the additively applied material should have comparable properties to the forged base material and, at the same time, the process should reach buildup rates in the range of several kilograms per hour.

Method

To increase the buildup rate, Fraunhofer ILT developed the process parameters for the LMD process and buildup strategies for laser powers of several kilowatts. To minimize the oxygen input into the deposited volume, the institute carries out the process in an inert gas chamber. Subsequent heat treatment is performed to set the desired material properties.

Results

Demonstrators made of TiAl6V4 can be successfully produced at deposition rates of up to 4 kg/h through the targeted design of the process control, and the mechanical properties meet the stringent requirements of the aerospace industry. Additional sample parts for other applications have already been produced and finished.

Applications

In addition to titanium alloys, all technical forging alloys can be processed. Applications are mainly found where high-quality, larger components have to be manufactured in small or medium quantities, e.g. in the aerospace industry, energy technology or general mechanical engineering. In addition to additive manufacturing, these processes are also suitable for repairing and reconditioning components, thus saving expensive materials.

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3 Additive-applied contour
on a forged component.

4 Finished hybrid component.